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Exercise - I (Conceptual Questions) Build Up Your Understanding

PERIODIC MOTION AND ITS CHARACTERISTICS

1. A particle of mass m is executing S.H.M. If amplitude is a and frequency n, the value of its force constant will be :
(1) mn^2 (2) $4mn^2a^2$
(3) ma^2 (4) $4\pi^2mn^2$

2. The equation of motion of a particle executing S.H.M. where letters have usual meaning is :
(1) $\frac{d^2x}{dt^2} = -\frac{k}{m}x$ (2) $\frac{d^2x}{dt^2} = +\omega^2x$
(3) $\frac{d^2x}{dt^2} = -\omega^2x^2$ (4) $\frac{d^2x}{dt^2} = -kmx$

3. The equation of motion of a particle executing SHM is $\left(\frac{d^2x}{dt^2}\right) + kx = 0$. The time period of the particle will be :
(1) $2\pi/\sqrt{k}$ (2) $2\pi/k$
(3) $2\pi k$ (4) $2\pi\sqrt{k}$

4. Which of the following equation does not represent a simple harmonic motion :
(1) $y = a\sin\omega t$ (2) $y = b\cos\omega t$
(3) $y = a\sin\omega t + b\cos\omega t$ (4) $y = a\tan\omega t$

SIMPLE HARMONIC MOTION (SHM) AND ITS EQUATION

5. The displacement of a particle in S.H.M. is indicated by equation $y = 10\sin(20t + \pi/3)$ where y is in metres. The value of time period of vibration will be (in seconds) :
(1) $10/\pi$ (2) $\pi/10$
(3) $2\pi/10$ (4) $10/2\pi$

6. The value of phase at maximum displacement from the mean position of a particle in S.H.M. is:
(1) $\pi/2$ (2) π (3) Zero (4) 2π

7. The equation of a simple harmonic motion is $x = 0.34\cos(3000t + 0.74)$. Where x and t are in mm and sec. respectively. The frequency of the motion is :
(1) 3000 (2) $3000/2\pi$
(3) $0.74/2\pi$ (4) $3000/\pi$

8. The acceleration of a particle executing S.H.M. is
(1) Always directed towards the equilibrium position
(2) Always towards the one end
(3) Continuously changing in direction
(4) Maximum at the mean position

9. The distance covered by a particle executing SHM, in one time period is equal to :
(1) Four times the amplitude
(2) Two times the amplitude
(3) One times the amplitude
(4) Eight times the amplitude

10. The phase of a particle in S.H.M. is $\pi/2$, then :
(1) Its velocity will be maximum.
(2) Its acceleration will be minimum.
(3) Restoring force on it will be minimum.
(4) Its displacement will be maximum.

11. The displacement of a particle in S.H.M. is indicated by equation $y = 10\sin(20t + \pi/3)$ where y is in metres. The value of maximum velocity of the particle will be :
(1) 100 m/sec. (2) 150 m/sec.
(3) 200 m/sec. (4) 400 m/sec.

12. In the above question, the value of phase constant will be :
(1) Zero (2) 45° (3) 60° (4) 30°

13. The phase of a particle in SHM at time t is $\pi/6$. The following inference is drawn from this:
(1) The particle is at $x = a/2$ and moving in + X-direction
(2) The particle is at $x = a/2$ and moving in – X-direction
(3) The particle is at $x = -a/2$ and moving in + X-direction
(4) The particle is at $x = -a/2$ and moving in – X-direction

14. Two particles execute S.H.M. along the same line at the same frequency. They move in opposite direction at the mean position. The phase difference will be :
(1) 2π (2) $2\pi/3$ (3) π (4) $\pi/2$

15. The displacement from mean position of a particle in SHM at 3 seconds is $\sqrt{3}/2$ of the amplitude. Its time period will be :
(1) 18 sec. (2) $6\sqrt{3}$ sec.
(3) 9 sec. (4) $3\sqrt{3}$ sec.

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16. A particle executes SHM of type $x = a\sin\omega t$. It takes time t_1 from $x = 0$ to $x = \frac{a}{2}$ and t_2 from $x = \frac{a}{2}$ to $x = a$. The ratio of $t_1 : t_2$ will be :
(1) 1 : 1 (2) 1 : 2
(3) 1 : 3 (4) 2 : 1

17. The time taken by a particle in SHM for maximum displacement is :
(1) T/8 (2) T/6 (3) T/2 (4) T/4

18. A particle executes SHM with periodic time of 6 seconds. The time taken for traversing a distance of half the amplitude from mean position is :
(1) 3 sec. (2) 2 sec.
(3) 1 sec. (4) 1/2 sec.

19. The phase difference between the displacement and acceleration of particle executing S.H.M. in radian is :
(1) $\pi/4$ (2) $\pi/2$ (3) π (4) 2π

20. The phase difference in radians between displacement and velocity in S.H.M. is :
(1) $\pi/4$ (2) $\pi/2$ (3) π (4) 2π

21. If the maximum velocity of a particle in SHM is v_0. then its velocity at half the amplitude from position of rest will be :
(1) $v_0/2$ (2) v_0
(3) $v_0\sqrt{3/2}$ (4) $v_0\sqrt{3}/2$

22. At a particular position the velocity of a particle in SHM with amplitude a is $\sqrt{3}/2$ that at its mean position. In this position, its displacement is :
(1) a/2 (2) $\sqrt{3}$ a/2 (3) $a\sqrt{2}$ (4) $\sqrt{2a}$

23. The acceleration of a particle in SHM at 5 cm from its mean position is 20 cm/sec^2. The value of angular frequency in radians/sec will be :
(1) 2 (2) 4 (3) 10 (4) 14

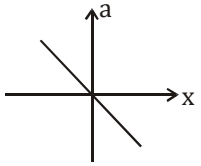
24. The amplitude of a particle in SHM is 5 cm and its time period is π. At a displacement of 3 cm from its mean position the velocity in cm/sec will be :
(1) 8 (2) 12 (3) 2 (4) 16

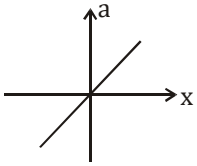
25. The maximum velocity and acceleration of a particle in S.H.M. are 100 cm/sec and 157 cm/sec^2 respectively. The time period in seconds will be :
(1) 4 (2) 1.57 (3) 0.25 (4) 1

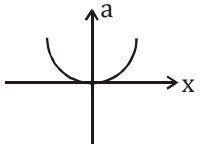
26. If the displacement, velocity and acceleration of a particle in SHM are 1 cm, 1cm/sec, 1cm/sec^2 respectively its time period will be (in seconds) :
(1) π (2) 0.5π (3) 2π (4) 1.5π

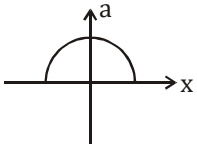
27. The particle is executing S.H.M. on a line 4 cm long. If its velocity at mean position is 12 cm/sec, its frequency in Hertz will be :
(1) $\frac{2\pi}{3}$ (2) $\frac{3}{2\pi}$ (3) $\frac{\pi}{3}$ (4) $\frac{3}{\pi}$

28. Which of the following statement is incorrect for an object executing S.H.M.:
(1) The value of acceleration is maximum at the extreme points
(2) The total work done for completing one oscillation is zero.
(3) The energy changes from one form to another
(4) The velocity at the mean position is zero

29. The variation of acceleration (a) and displacement (x) of the particle executing SHM is indicated by the following curve :
(1) 

(2) 

(3) 

(4) 

30. The time period of an oscillating body executing SHM is 0.05 sec and its amplitude is 40 cm. The maximum velocity of particle is :
(1) 16π ms^{-1} (2) 2π ms^{-1}
(3) 3.1 ms^{-1} (4) 4π m/s

31. A body of mass 5 gm is executing S.H.M. about a point with amplitude 10 cm. Its maximum velocity is 100 cm/sec. Its velocity will be 50 cm/sec at a distance from mean position :
(1) 5 cm (2) $5\sqrt{2}$ cm
(3) $5\sqrt{3}$ cm (4) $10\sqrt{2}$ cm

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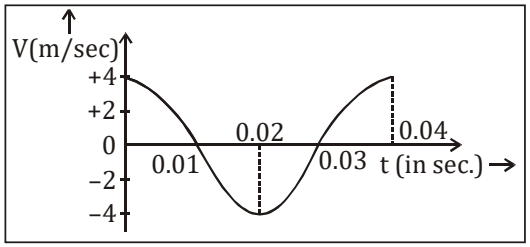
32. The velocity-time diagram of a harmonic oscillator is shown in the adjoining figure. The frequency of oscillation is :



(1) 25 Hz (2) 50 Hz
(3) 12.25 Hz (4) 33.3 Hz

33. If amplitude of the particle which is executing S.H.M., is doubled, then which quantity will become double?
(1) Frequency
(2) Time period
(3) Energy
(4) Maximum velocity

34. Which one of the following statements is true for the speed 'v' and the acceleration 'a' of a particle executing simple harmonic motion
(1) Value of 'a' is zero, whatever may be the value of 'v'
(2) When 'v' is zero, 'a' is zero
(3) When 'v' is maximum, 'a' is zero
(4) When 'v' is maximum, 'a' is maximum

35. For a particle executing simple harmonic motion which of the following statement is not correct:
(1) The total energy of particle always remains the same
(2) The restoring force is always directed towards a fix point.
(3) The restoring force is maximum at the extreme positions.
(4) The acceleration of particle is maximum at the equilibrium positions.

36. In SHM velocity is maximum:
(1) At extreme position
(2) When displacement is half of amplitude
(3) At the central position
(4) When Displacement is $\frac{1}{\sqrt{2}}$ of amplitude

37. A body oscillates with SHM according to the equation $x = 5.0\cos(2\pi t + \pi)$. At time $t = 1.5$ s, its displacement, speed and acceleration respectively is :
(1) $0, -10\pi, +20\pi^2$ (2) $5, 0, -20\pi^2$
(3) $2.5, +20\pi, 0$ (4) $-5.0, +5\pi, -10\pi^2$

38. The maximum velocity of simple harmonic motion represented by $y = 3\sin\left(100t + \frac{\pi}{6}\right)$ is given by
(1) 300 (2) $\frac{3\pi}{6}$
(3) 100 (4) $\frac{\pi}{6}$

39. The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm is 4.4 m/s. The period of oscillation is :
(1) 100 s (2) 0.01 s (3) 10 s (4) 0.1 s

40. Average velocity of a particle performing SHM in one time period is :-
(1) Zero (2) $\frac{A\omega}{2}$ (3) $\frac{A\omega}{2\pi}$ (4) $\frac{2A\omega}{\pi}$

41. A particle is executing S.H.M. with amplitude A and Time period T. Time taken by the particle to reach from extreme position to $\frac{A}{2}$
(1) $\frac{T}{6}$ (2) $\frac{T}{12}$ (3) $\frac{T}{3}$ (4) $\frac{T}{4}$

42. Total work done on a simple pendulum in one complete oscillation will be :-
(1) $\frac{1}{2}kx^2$ (2) $\frac{1}{2}kA^2$
(3) kA^2 (4) Zero

43. In S.H.M. Which one of the following quantities has constant ratio with acceleration :-
(1) Time (2) Displacement
(3) Velocity (4) Mass

44. The displacement y of a particle varies with time t, in seconds, as $y = 2\cos(\pi t + \pi/6)$. The time period of the oscillations is
(1) 2 s (3) 4 s (3) 1 s (4) 0.5 s

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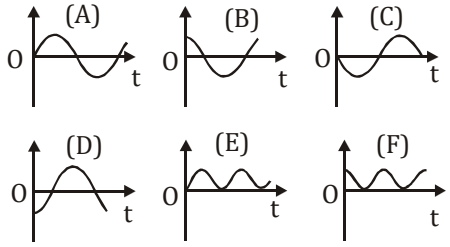
ENERGY IN SHM-KINETIC AND POTENTIAL ENERGIES

45. The displacement of a particle in S.H.M. is x = asinωt. Which of the following graph between displacement and time is correct :



(1) A (2) B (3) C (4) D

46. In previous question which of the graph between velocity and time is correct?

(1) A (2) B (3) C (4) D

47. In Question 45 which of the graph between kinetic energy and time is correct?

(1) A (2) B (3) E (4) F

48. In Question 45 which of the graph between potential energy and time is correct?

(1) A (2) B (3) E (4) F

49. In Question 45 which of the graph between acceleration and time is correct?

(1) A (2) B (3) C (4) D

50. In Question 45 if the displacement of a particle executing SHM is x = a cosωt, which of the graph between displacement and time is correct?

(1) A (2) B (3) C (4) D

51. In question 50 which of the graph between velocity and time is correct?

(1) A (2) B (3) C (4) D

52. In question 50 which of the graph between acceleration and time is correct?

(1) A (2) B (3) C (4) D

53. In question 50 which of the graph between K.E. and time is correct?

(1) A (2) B (3) E (4) F

54. In question 50 which of the graph between P.E. and time is correct?

(1) A (2) B (3) E (4) F

55. The total energy of a particle executing SHM is directly proportional to the square of the following quantity :

(1) Acceleration (2) Amplitude
(3) Time period (4) Mass

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56. The total energy of a vibrating particle in SHM is E. If its amplitude and time period are doubled, its total energy will be :

(1) 16E (2) 8E (3) 4E (4) E

57. The total vibrational energy of a particle in S.H.M. is E. Its kinetic energy at half the amplitude from mean position will be :

(1) E/2 (2) E/3 (3) E/4 (4) 3E/4

58. If total energy of a particle in SHM is E, then the potential energy of the particle at half the amplitude will be :

(1) E/2 (2) E/4 (3) 3E/4 (4) E/8

59. A particle executes SHM on a line 8 cm long. Its K.E. and P.E. will be equal when its distance from the mean position is :

(1) 4 cm (2) 2 cm
(3) $2\sqrt{2}$ cm (4) $\sqrt{2}$ cm

60. The average P.E. of a body executing S.H.M. is :

(1) $\frac{1}{2}ka^2$ (2) $\frac{1}{4}ka^2$ (3) ka^2 (4) Zero

61. The value of total mechanical energy of a particle in S.H.M. is :

(1) Always constant (2) Depend on time
(3) $\frac{1}{2}kA^2\cos^2(\omega t+\phi)$ (4) $\frac{1}{2}mA^2\cos^2(\omega t+\phi)$

62. The maximum K.E. of a oscillating spring is 5 joules and its amplitude 10 cm. The force constant of the spring is :

(1) 100 Newton/m. (2) 1000 Newton–m
(3) 1000 Newton/m. (4) 1000 watts.

63. The force acting on a 4gm mass in the energy region $U = 8x^2$ at x = –2cm is :

(1) 8 dyne (2) 4 dyne
(3) 16 dyne (4) 32 dyne

64. Displacement between max. P.E. position and max. K.E. position for a particle executing simple harmonic motion is :

(1) $\pm\frac{a}{2}$ (2) + a
(3) ± a (4) – 1

65. A particle is describing SHM with amplitude 'a'. When the potential energy of particle is one fourth of the maximum energy during oscillation, then its displacement from mean position will be:

(1) $\frac{a}{4}$ (2) $\frac{a}{3}$ (3) $\frac{a}{2}$ (4) $\frac{2a}{3}$

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66. The ratio of K.E. of the particle at mean position to the point when distance is half of amplitude will be:

(1) $\frac{1}{3}$ (2) $\frac{2}{3}$ (3) $\frac{4}{3}$ (4) $\frac{3}{2}$

67. A particle is executing S.H.M., If its P.E. & K.E. is equal then the ratio of displacement & amplitude will be :

(1) $\frac{1}{\sqrt{2}}$ (2) $\sqrt{2}$ (3) $\frac{1}{2}$ (4) $\frac{3}{2}$

68. Which of the following is constant during SHM:

(1) Velocity (2) Acceleration
(3) Total energy (4) Phase

69. If <E> and <V> denotes the average kinetic and average potential energies respectively of mass describing a simple harmonic motion over one period then the correct relation is:

(1) <E> = <V> (2) <E> = 2<V>
(3) <E> = –2<V> (4) <E> = – <V>

70. The elongation of spring is 1 cm and its potential energy is U. If the spring is elongated by 3cm then potential energy will be :-

(1) 3U (2) $\frac{U}{3}$ (3) 9U (4) $\frac{U}{9}$

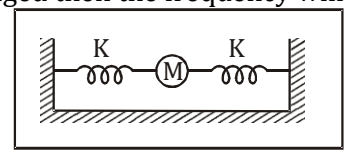
71. The potential energy of a spring when stretched by a distance x is E. The energy of the spring when stretched by x/2 is

(1) E (2) E/2 (3) E/4 (4) E/6

OSCILLATIONS OF A SPRING

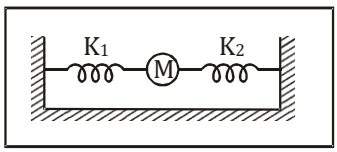
72. On suspending a mass M from a spring of force constant K, frequency of vibration f is obtained.

If a second spring as shown in the figure, is arranged then the frequency will be :



(1) $f\sqrt{2}$ (2) $f/\sqrt{2}$ (3) 2f (4) f

73. In the adjoining figure the frequency of oscillation for a mass M will be proportional to :



(1) K_1K_2 (2) $K_1 + K_2$
(3) $\sqrt{K_1+K_2}$ (4) $\sqrt{1/K_1+K_2}$

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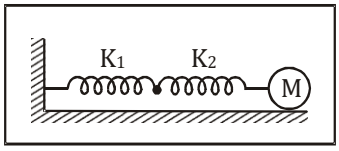
74. An object of mass m is suspended from a spring and it executes S.H.M. with frequency υ. If the mass is increased 4 times, the new frequency will be :

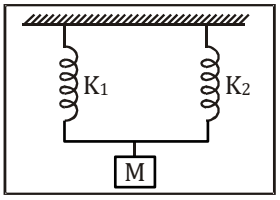
(1) 2υ (2) υ/2 (3) υ (4) υ/4

75. As shown in the figure, two light springs of force constant K_1 and K_2 oscillate a block of mass M. Its effective force constant will be :



(1) K_1K_2 (2) $K_1 + K_2$
(3) $\frac{1}{K_1}+\frac{1}{K_2}$ (4) $\frac{K_1K_2}{K_1+K_2}$

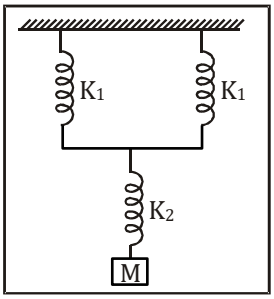
76. The spring constants of two springs of same length are K_1 and K_2 as shown in figure. If an object of mass M is suspended and set vibration, the time period will be :



(1) $2\pi\sqrt{\frac{MK_1}{K_2}}$ (2) $2\pi\sqrt{\frac{M}{K_1K_2}}$
(3) $2\pi\sqrt{\frac{M}{K_1-K_2}}$ (4) $2\pi\sqrt{M/(K_1+K_2)}$

77. The total spring constant of the system as shown in the figure will be :

(1) $\frac{K_1}{2}+K_2$
(2) $\left[\frac{1}{2K_1}+\frac{1}{K_2}\right]^{-1}$
(3) $\frac{1}{2K_1}+\frac{1}{K_2}$
(4) $\left[\frac{2}{K_1}+\frac{1}{K_2}\right]^{-1}$



78. A spring is made to oscillate after suspending a mass m from one of its ends. The time period obtained is 2 seconds. On increasing the mass by 2 kg, the period of oscillation is increased by 1 second. The initial mass m will be :

(1) 2 kg (2) 1 kg
(3) 0.5 kg (4) 1.6 kg

79. The time period of a spring pendulum on earth is T. If it is taken on the moon, and made to oscillate, the period of vibration will be :
(1) Less than T (2) Equal to T
(3) More than T (4) None of these

80. On loading a spring with bob, its period of oscillation in a vertical plane is T. If this spring pendulum is tied with one end to the a friction less table and made to oscillate in a horizontal plane, its period of oscillation will be :
(1) T
(2) 2T
(3) T/2
(4) will not execute S.H.M.

81. In a winding (spring) watch, the energy is stored in the form of :
(1) Kinetic energy (2) Potential energy
(3) Electrical energy (4) None of these

82. In an artificial satellite, the object used is :
(1) Spring watch
(2) Pendulum watch
(3) Watches of both spring and pendulum
(4) None of these

83. Mass 'm' is suspended from a spring of force constant K. Spring is cut into two equal parts and same mass is suspended from it, then new frequency will be:
(1) 2ν (2) $\sqrt{2}\,\nu$ (3) ν (4) $\frac{\nu}{2}$

84. The spring constant of two springs are K_1 and K_2 respectively springs are stretch up to that limit when potential energy of both becomes equal. The ratio of applied force (F_1 and F_2) on them will be :
(1) $K_1 : K_2$ (2) $K_2 : K_1$
(3) $\sqrt{K_1} : \sqrt{K_2}$ (4) $\sqrt{K_2} : \sqrt{K_1}$

85. Force constant of a spring is K. If one fourth part is detach then force constant of remaining spring will be :
(1) $\frac{3}{4}K$ (2) $\frac{4}{3}K$ (3) K (4) 4K

86. The spring constant of a spring is K. When it is divided into n equal parts, then what is the spring constant of one part :
(1) nK (2) K/n
(3) $\frac{nK}{(n+1)}$ (4) $\frac{(n+1)K}{n}$

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87. A mass of 10g is connected to a massless spring then time period of small oscillation is 10 second. If 10 g mass is replaced by 40 g mass in same spring, then its time period will be:-
(1) 5s (2) 10s (3) 20s (4) 40s

SIMPLE PENDULUM

88. The mass of a bob, suspended in a simple pendulum, is halved from the initial mass, its time period will :
(1) Be less (2) Be more
(3) Remain unchanged (4) None of these

89. If the amplitude of a simple pendulum is doubled, how many times will the value of its maximum velocity be that of the maximum velocity in initial case :
(1) $\frac{1}{2}$ (2) 2 (3) 4 (4) $\frac{1}{4}$

90. The length of a simple pendulum is $39.2/\pi^2$ m. If g = 9.8 m/sec^2, the value of time period is:
(1) 4 s (2) 8 s (3) 2 s (4) 3 s

91. The length of a simple pendulum is increased four times of its initial value, its time period with respect to its previous value will :
(1) Become twice (2) Not be different
(3) Be halved (4) Be $\sqrt{2}$ times

92. The time taken for a second pendulum from one extreme point to another is :
(1) 1 s (2) 2 s (3) 1/2 s (4) 4 s

93. The length of a seconds pendulum is (approximately) :
(1) 1 m (2) 1 cm (3) 2 m (4) 2 cm

94. The acceleration due to gravity at height R above the surface of the earth is g/4. The periodic time of a simple pendulum in an artificial satellite at this height will be :
(1) $T = 2\pi\sqrt{2l/g}$ (2) $T = 2\pi\sqrt{l/2g}$
(3) Zero (4) Infinity

95. An oscillating pendulum stops, because its energy
(1) Changes into kinetic energy
(2) Change into potential energy
(3) Change into heat energy
(4) Is destroyed

96. Simple pendulum of large length is made equal to the radius of the earth. Its period of oscillation will be :
(1) 84.6 min. (2) 59.8 min.
(3) 42.3 min. (4) 21.15 min.

97. The maximum time period of oscillation of a simple pendulum of large length is:
(1) Infinity (2) 24 hours
(3) 12 hours (4) 1½ hours

98. In a simple oscillating pendulum, the work done by the string in one oscillation will be:
(1) Equal to the total energy of the pendulum
(2) Equal to the K.E. of the pendulum
(3) Equal to the P.E. of the pendulum
(4) Zero

99. A lift is ascending with acceleration g/3. What will be the time period of a simple pendulum suspended from its ceiling if its time period in stationary lift is T?
(1) $\frac{T}{2}$ (2) $\frac{\sqrt{3}T}{2}$ (3) $\frac{\sqrt{3}T}{4}$ (4) $\frac{T}{4}$

100. A child swinging on a swing in sitting position, stands up, then the period of the swing will be:
(1) Increase
(2) Decrease
(3) Remain same
(4) Increase if child is long and decrease if child is short

101. A simple pendulum is suspended from the ceiling of a vehicle, its time period is T. Vehicle is moving with constant velocity, then time period of simple pendulum will be :
(1) Less than T (2) Equal to T
(3) More than T (4) Cannot predict

SUPERPOSITION OF SHMs, FREE, FORCED AND DAMPED OSCILATIONS, RESONANCE

102. The vibrations taking place in the diaphragm of a microphone will be :-
(1) free vibrations
(2) damped vibrations
(3) forced vibrations
(4) electrically maintained vibrations

103. In the case of sustained forced oscillations the amplitude of oscillations :-
(1) decreases linearly
(2) decreases sinusoidally
(3) decreases exponentially
(4) always remains constant

104. Two sources of sound are in resonance when :-
(1) they look alike
(2) they are situated at a particular distance from each other
(3) they produce the sound of same intensity
(4) they are excited by the same exciting device

105. When a tuning fork is vibrated, another in the neighbourhood begins to vibrate. This is due to the phenomenon of :-
(1) gravitation (2) Newton's III law
(3) Resonance (4) None

106. The amplitude of a SHM reduces to 1/3 in first 20 second then in first 40 second its amplitude becomes:
(1) $\frac{1}{3}$ (2) $\frac{1}{9}$ (3) $\frac{1}{27}$ (4) $\frac{1}{\sqrt{3}}$

107. Amplitude of vibrations remains constant in case of
(i) free vibrations
(ii) damped vibrations
(iii) maintained vibrations
(iv) forced vibrations
(1) i, iii, iv (2) ii, iii
(3) i, ii, iii (4) ii, iv

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	1	1	4	2	1	2	1	1	4	3	3	1	3	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	4	4	3	2	4	1	1	1	1	3	4	4	1	1
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	1	4	3	4	3	2	1	2	1	1	4	2	1	1
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	2	4	3	3	2	3	4	3	4	2	4	4	2	3	2
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	1	3	4	3	3	3	1	3	1	3	3	1	3	2	4
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	4	2	4	2	1	2	1	2	3	2	1	3	3	2	1
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	1	1	1	4	3	2	4	4	2	2	2	3	4	4	3
Question	106	107													
Answer	2	1													

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. The potential energy of a long spring when stretched by 2cm is U. If the spring is stretched by 8 cm the potential energy stored in it is :-

(1) 4 U (2) 8 U (3) 16 U (4) $\frac{U}{4}$

AIPMT 2007

2. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is :-

(1) Zero (2) 0.5 π

(3) π (4) 0.707π

3. The particle executing simple harmonic motion has a kinetic energy $K_o \cos^2 \omega t$. The maximum value of the potential energy and the total energy are respectively :-

(1) K_o and K_o (2) 0 and $2K_o$

(3) $\frac{K_o}{2}$ and K_o (4) K_o and $2K_o$

4. A particle executes simple harmonic oscillation with an amplitude a. The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is :-

(1) T/2 (2) T/4 (3) T/8 (4) T/12

AIPMT 2008

5. Two simple harmonic motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is:-

(1) $1 : 10^3$ (2) $1 : 10^4$

(3) 1 : 10 (4) $1 : 10^2$

6. A point performs simple harmonic oscillation of period T and the equation of motion is given by $x = a \sin(\omega t + \pi/6)$. After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

(1) T/3 (2) T/12

(3) T/8 (4) T/6

AIPMT 2009

7. A simple pendulum performs simple harmonic motion about x = 0 with an amplitude a and time period T. The speed of the pendulum at x = a/2 will be :-

(1) $\frac{\pi a\sqrt{3}}{T}$ (2) $\frac{\pi a\sqrt{3}}{2T}$ (3) $\frac{\pi a}{T}$ (4) $\frac{3\pi^2 a}{T}$

8. Which one of the following equations of motion represents simple harmonic motion :-

(1) Acceleration = kx

(2) Acceleration = $-k_0x+k_1x^2$

(3) Acceleration = $-k(x + a)$

(4) Acceleration = $k(x + a)$

Where k, k_0, k_1 and a are all positive

AIPMT (Pre) 2010

9. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass M is also suspended, the period of oscillation will now be :-

(1) $\sqrt{2}T$ (2) T

(3) $\frac{T}{\sqrt{2}}$ (4) 2T

AIPMT (Pre) 2011

10. Out of the following functions representing motion of a particle which represents SHM :

(A) $y = \sin\omega t - \cos\omega t$

(B) $y = \sin^3\omega t$

(C) $y = 5\cos\left(\frac{3\pi}{4} - 3\omega t\right)$

(D) $y = 1 + \omega t + \omega^2 t^2$

(1) Only (A)

(2) Only (D) does not represent SHM

(3) Only (A) and (C)

(4) Only (A) and (B)

AIPMT (Mains) 2011

11. Two particles are oscillating along two close parallel straight lines side by side, with the same frequency and amplitudes. They pass each other, moving in opposite directions when their displacement is half of the amplitude. The phase difference is:-

(1) $\frac{\pi}{6}$ (2) 0 (3) $\frac{2\pi}{3}$ (4) π

TG: @Chalnaayaaar

AIPMT 2014

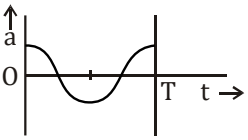
12. The oscillation of a body on a smooth horizontal surface is represented by the equation,

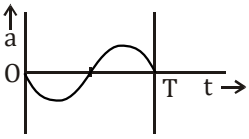
$X = A\cos(\omega t)$

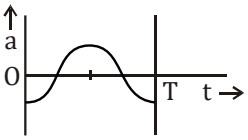
where X = displacement at time t

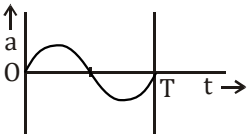
ω = angular frequency of oscillation

Which one of the following graphs shows correctly the variation acceleration 'a' with time 't'?

(1) 

(2) 

(3) 

(4) 

AIPMT 2015

13. When two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed the motion is :

(1) simple harmonic with amplitude $\frac{a}{b}$

(2) simple harmonic with amplitude $\sqrt{a^2+b^2}$

(3) simple harmonic with amplitude $\frac{(a+b)}{2}$

(4) not a simple harmonic

14. A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is :-

(1) $2\pi\sqrt{\frac{x_2^2-x_1^2}{V_1^2-V_2^2}}$ (2) $2\pi\sqrt{\frac{V_1^2+V_2^2}{x_1^2+x_2^2}}$

(3) $2\pi\sqrt{\frac{V_1^2-V_2^2}{x_1^2-x_2^2}}$ (4) $2\pi\sqrt{\frac{x_1^2+x_2^2}{V_1^2+V_2^2}}$

TG: @Chalnaayaaar

15. Two similar springs P and Q have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (case a) then by the same force (case b). The work done by the springs W_P and W_Q are related as, in case (a) and case (b), respectively :

(1) $W_P = W_Q$; $W_P = W_Q$

(2) $W_P > W_Q$; $W_Q > W_P$

(3) $W_P < W_Q$; $W_Q < W_P$

(4) $W_P = W_Q$; $W_P > W_Q$

RE-AIPMT 2015

16. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then its time period of vibration will be :-

(1) $\frac{2\pi\beta}{\alpha}$ (2) $\frac{\beta^2}{\alpha^2}$ (3) $\frac{\alpha}{\beta}$ (4) $\frac{\beta^2}{\alpha}$

NEET-II 2016

17. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3s. When the mass m is increased by 1 kg, the time period of oscillations becomes 5 s. The value of m in kg is :-

(1) $\frac{16}{9}$ (2) $\frac{9}{16}$ (3) $\frac{3}{4}$ (4) $\frac{4}{3}$

NEET(UG) 2017

18. A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k''. Then k' : k'' is:-

(1) 1 : 9 (2) 1 : 11 (3) 1 : 14 (4) 1 : 16

19. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is :-

(1) $\frac{\sqrt{5}}{2\pi}$ (2) $\frac{4\pi}{\sqrt{5}}$ (3) $\frac{2\pi}{\sqrt{3}}$ (4) $\frac{\sqrt{5}}{\pi}$

NEET(UG) 2018

20. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 20 m/s² at a distance of 5 m from the mean position. The time period of oscillation is :-

(1) 2π s (2) π s (3) 2 s (4) 1 s

TG: @Chalnaayaaar

NEET(UG) 2019

21. The displacement of a particle executing simple harmonic motion is given by
$y = A_0 + A\sin\omega t + B\cos\omega t$.
Then the amplitude of its oscillation is given by :

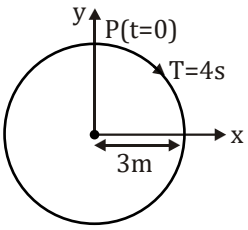
(1) $A_0 + \sqrt{A^2 + B^2}$ (2) $\sqrt{A^2 + B^2}$

(3) $\sqrt{A_0^2 + (A+B)^2}$ (4) A + B

22. Average velocity of a particle executing SHM in one complete vibration is :

(1) $\frac{A\omega}{2}$ (2) $A\omega$ (3) $\frac{A\omega^2}{2}$ (4) Zero

23. The radius of circle, the period of revolution, initial position and sense of revolution are indicated in the fig.



y-projection of the radius vector of rotating particle P is :

(1) $y(t) = -3\cos 2\pi t$, where y in m

(2) $y(t) = 4\sin\left(\frac{\pi t}{2}\right)$, where y in m

(3) $y(t) = 3\cos\left(\frac{3\pi t}{2}\right)$, where y in m

(4) $y(t) = 3\cos\left(\frac{\pi t}{2}\right)$, where y in m

NEET(UG) 2019 (Odisha)

24. The distance covered by a particle undergoing SHM in one time period is (amplitude = A) :-

(1) zero (2) A (3) 2A (4) 4A

25. A mass falls from a height 'h' and its time of fall 't' is recorded in terms of time period T of a simple pendulum. On the surface of earth it is found that t = 2T. The entire set up is taken on the surface of another planet whose mass is half of that of earth and radius the same. Same experiment is repeated and corresponding times noted as t' and T', then

(1) $t' = \sqrt{2}T'$ (2) $t' > 2T'$

(3) $t' < 2T'$ (4) $t' = 2T'$

TG: @Chalnaayaaar

NEET(UG) 2020

26. The phase difference between displacement and acceleration of a particle in a simple harmonic motion is :

(1) Zero (2) π rad

(3) $\frac{3\pi}{2}$ rad (4) $\frac{\pi}{2}$ rad

NEET(UG) 2020 (Covid-19)

27. Identify the function which represents a periodic motion

(1) $e^{\omega t}$ (2) $\log_e(\omega t)$

(3) $\sin\omega t + \cos\omega t$ (4) $e^{-\omega t}$

NEET(UG) 2021

28. A body is executing simple harmonic motion with frequency 'n', the frequency of its potential energy is : -

(1) n (2) 2n

(3) 3n (4) 4n

29. A spring is stretched by 5 cm by a force 10 N. The time period of the oscillations when a mass of 2 kg is suspended by it is :

(1) 0.0628 s (2) 6.28 s

(3) 3.14 s (4) 0.628 s

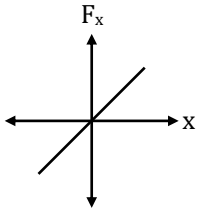
NEET(UG) 2022

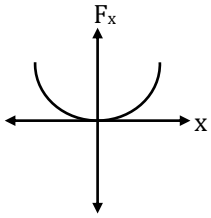
30. Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is :

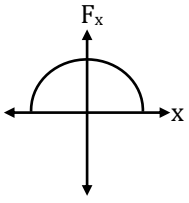
(1) 9 (2) 10 (3) 8 (4) 11

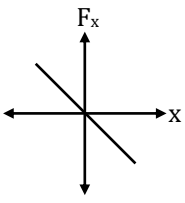
RE-NEET(UG) 2022

31. The restoring force of a spring with a block attached to the free end of the spring is represented by :

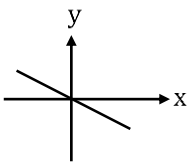
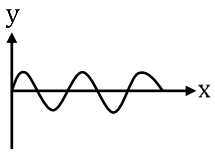
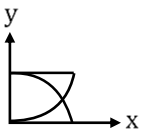
(1) 

(2) 

(3) 

(4) 

32. Match List - I with List - II :

	List –I (x-y graphs)		**List-II (Situations)**
(a)		(i)	Total mechanical energy is conserved
(b)		(ii)	Bob of a pendulum is oscillating under negligible air friction
(c)		(iii)	Restoring force of a spring
(d)		(iv)	Bob of a pendulum is oscillating along with air friction

Choose the correct answer from the options given below :

(1) (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)

(2) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

(3) (a) - (i), (b) - (iv), (c) - (iii), (d) - (ii)

(4) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)

33. Identify the function which represents a non-periodic motion.

(1) $e^{-\omega t}$

(2) $\sin\omega t$

(3) $\sin\omega t + \cos\omega t$

(4) $\sin(\omega t + \pi/4)$

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	2	1	4	4	2	1	3	1	3	3	3	2	1	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	2	2	2	2	2	4	4	4	4	2	3	2	4	4
Question	31	32	33												
Answer	4	2	1												

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Exercise - III (Analytical Questions) Master Your Understanding

1. The equation of motion for an oscillating particle is given by

$x = 3\sin 4\pi t + 4\cos 4\pi t$

where x is in cm and t is in sec. Choose the correct statements :

(a) the motion is simple harmonic

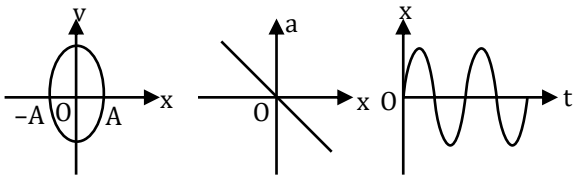
(b) amplitude of oscillationg is 5 cm

(c) motion is periodic

(1) a, b, c (2) Only a, b

(3) Only b, c (4) Only b

2. For a particle excuting S.H.M.



(a) (b) (c)

Select the correct graph.

(1) only a (2) only b

(3) both (a) & (b) (4) all (a), (b) & (c)

3. Match the column

Column-I		Column-II	
(i)	t=0 → M.P.	(a)	x = Acosωt
(ii)	t=0, M.P., +A	(b)	x = Asinωt
(iii)	t=0 ← M.P.	(c)	x = –Asinωt
(iv)	t=0, –A, M.P.	(d)	x = –Acosωt

Choose the correct option :

(1) i→b, ii→d, iii→a, iv→c

(2) i→c, ii→d, iii→b, iv→a

(3) i→b, ii→a, iii→c, iv→d

(4) i→a, ii→c, iii→d, iv→b

4. A spring has natural length 40 cm and spring constant 500 N/m. A block of mass 1 kg is attached at one end of the spring and others end of the spring is attached to the wall in horizontal position. The block release from the position, where the spring has length 45 cm then choose the correct statements :

(A) The block will perform SHM of amplitude 5 cm

(B) The block will have maximum velocity $50\sqrt{5}$ cm/sec.

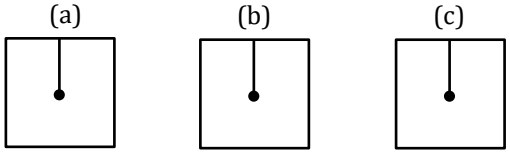
(C) The block will have maximum acceleration at released position

(D) The minimum P.E. of the spring will be zero

(1) only (A) (2) only (B)

(3) both (A) & (B) (4) (A), (B), (C), (D)

5. A simple pendulum is suspended from the celling of a lift. Three cases of lift are given



(a) Lift is at rest

(b) Lift is moving downward with constant speed

(c) Lift is moving downward with increasing speed

In which case time period of pendulum is $T = 2\pi\sqrt{\frac{\ell}{g}}$

(1) only in (a) (2) only in (b)

(3) only in (c) (4) in both (a) & (b)

6. A particle is executing linear SHM. For this match the following :-

i	If mass of the block is doubled (keeping other factor constant)	a	Energy of oscillation becomes 4 times
ii	If amplitude of oscillation is doubled (keeping other factor constant)	b	Max. speed of the particle becomes half times

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iii	If force constant is doubled (keeping other factor constant)	c	Time period become $\sqrt{2}$ times
iv	If angular freq. is halved (keeping mass constant)	d	Max. potential energy becomes 2 times

(1) i – c, ii – a, iii – d, iv – b
(2) i – c, ii – a, iii – b, iv – d
(3) i – a, ii – c, iii – b, iv – d
(4) i – c, ii – b, iii – d, iv – a

7. A particle performing SHM with time period T according to the equation $x = A\sin\omega t$ then match the following :-

i	time taken to displace from x = 0 to x = A/2	a	$\frac{T}{24}$
ii	time taken to displace from x = A/2 to x = A	b	$\frac{T}{8}$
iii	time taken to go form $x = A/\sqrt{2}$ to $x = \sqrt{3}A/2$	c	$\frac{T}{12}$
iv	time taken to displace from $x = A/\sqrt{2}$ to x = A	d	$\frac{T}{6}$

(1) i – c, ii – a, iii – d, iv – b
(2) i – c, ii – a, iii – b, iv – d
(3) i – c, ii – d, iii – a, iv – b
(4) i – c, ii – b, iii – d, iv – a

8. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : General vibration of a polyatomic molecule about its equilibrium position is periodic but not SHM.

Reason (R) : A periodic motion can always be expressed as a sum of infinite number of harmonic motion with appropriate amplitude.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

TG: @Chalnaayaaar

9. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : All simple harmonic motion are periodic.

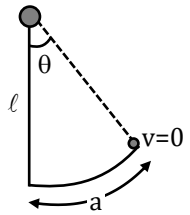
Reason (R) : Periodic motion is the motion in which the particle repeats its motion in a fixed time internal.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

10. Given blow are two statements:

Statement I : The motion of a simple pendulum is simple harmonic only if $a << \ell$.



Statement II : The motion of a simple pendulum is simple harmonic for large angular displacement.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

11. Given blow are two statements:

Statement I : SHM is not an example of uniformly accelerated motion.

Statement II : SHM is the projection of uniform circular motion along one of the diameter of the circle.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

12. Given blow are two statements:

Statement I : In linear SHM net force always act in the direction of velocity.

Statement II : In linear SHM direction of velocity changes.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

13. Given blow are two statements:

Statement I : In damped oscillation amplitude of the particle decreases exponentially with time.

Statement II : In forced oscillation amplitude of a particle can maintained constant with time.

In light of above statement choose the most **appropriate** answer from the options given below:

(1) Both statement I and statement II are correct.

(2) Statement I is correct and statement II is incorrect.

(3) Statement I is incorrect and statement II is correct.

(4) Both statements I and statements II are incorrect.

TG: @Chalnaayaaar

14. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : A small body suspended by a light spring performing SHM. When the entire system is immersed in a non-viscous liquid period of oscillationg does not change.

Reason (R) : In simple harmonic motion the acceleration is always in a direction opposite to that of the displacement from mean position.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

15. Motion of a ball bearing inside a smooth fixed bowl, when released from a point slightly above the lower point is

(A) simple harmonic motion.

(B) non-periodic motion.

(C) periodic motion.

(D) non-oscillatory motion

(1) A,C (2) B,D (3) C,D (4) None

16. A particle moves such that its position from origin is given by $x = 2 + 3\sin^2\omega t$. Choose **CORRECT** statement(s) about its motion :-

(A) Particle performs S.H.M. of amplitude $\frac{3}{2}$m and frequency $\frac{\omega}{\pi}$

(B) Particle performs oscillations but no S.H.M.

(C) Particle performs S.H.M. about mean position at $x = \frac{7}{2}$m

(D) Particle performs oscillations of amplitude 3m

(1) B,D (2) A,C (3) A,C,D (4) None

17. **STATEMENT – I :** In SHM let x be the maximum speed, y the frequency of oscillation and z the maximum acceleration, then $\left(\frac{xy}{z}\right)$ is a constant quantity.

and

STATEMENT – II : This is because $\left(\frac{xy}{z}\right)$ becomes a dimensionless quantity

(1) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.

(2) Statement-I is true, statement-II is true and statement-II is NOT the correct explanation for statement-I.

(3) Statement-I is true, statement-II is false.

(4) Statement-I is false, statement-II is true.

18. **Statement–I :** Total energy in SHM will be always more than or equal to potential energy.

and

Statement–II : Total energy in SHM will be always more than or equal to kinetic energy.

(1) Statement–I is True, Statement–II is True; Statement–II is a correct explanation for Statement–I.

(2) Statement–I is True, Statement–II is True; Statement–II is not a correct explanation for Statement–I.

(3) Statement–I is True, Statement–II is False.

(4) Statement–I is False, Statement–II is True.

19. A vertical spring block system is made to oscillate.

Statement I : Its time period on earth is more than that on the moon.

and

Statement II : Its extension on earth (in equilibrium) is more than that on the moon.

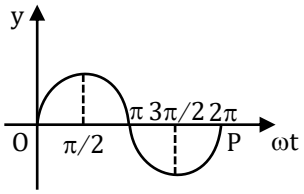
(1) Statement-I is true, statement-II is true and statement-II is correct explanation for statement-I.

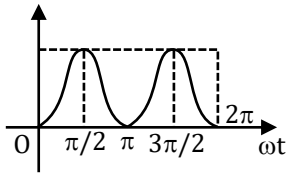
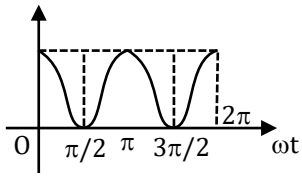
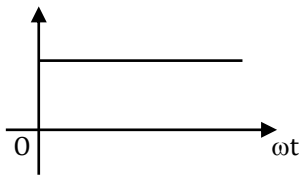
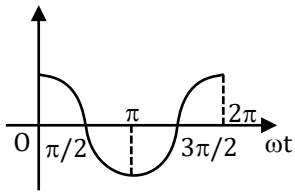
(2) Statement-I is true, statement-II is true and statement-II is NOT the correct explanation for statement-I.

(3) Statement-I is true, statement-II is false.

(4) Statement-I is false, statement-II is true.

20. The graph plotted between phase angle (ϕ) and displacement of a particle from equilibrium position (y) is a sinusoidal curve as shown below. Then the best matching is



Column A		Column B	
(a)	K.E. versus phase angle curve	(i)	
(b)	P.E. versus phase angle curve	(ii)	
(c)	T.E. versus phase angle curve	(iii)	
(d)	Velocity versus phase angle curve	(iv)	

(1) (a)-(i), (b)-(ii), (c)-(iii) & (d)-(iv)

(2) (a)-(ii), (b)-(i), (c)-(iii) & (d)-(iv)

(3) (a)-(ii), (b)-(i), (c)-(iv) & (d)-(iii)

(4) (a)-(ii), (b)-(iii), (c)-(iv) & (d)-(i)

21. **Statement I** : Displacement–time equation of a particle moving along x–axis is $x = 4 + 6\sin\omega t$. Under this situation, motion of particle is not simple harmonic.

and

Statement II : for the given equation $\frac{d^2x}{dt^2}$ is not proportional to –x.

(1) Statement–I is True, Statement–II is True ; Statement–II is a correct explanation for Statement–I.

(2) Statement–I is True, Statement–II is True ; Statement–II is not a correct explanation for Statement–I.

(3) Statement–I is True, Statement–II is False.

(4) Statement–I is False, Statement–II is True.

22. The angle made by the string of a simple pendulum with the vertical depends upon time as $\theta = \frac{\pi}{90}\sin \pi t$. Find the length of the pendulum if $g = \pi^2\ ms^{-1}$

(1) 1 m (2) 1 cm (3) 10 m (4) 10 cm

23. **Statement–I :** Cavalry troops are asked not to march in cadence across a suspension bridge otherwise bridge may collapse.

Statement–II : If the soldiers march in cadence, in every step they step down at exactly the same instant producing a very large impulse on the bridge, which may cause it to collapse.

(1) Statement–I is true, statement–II is true; statement–II is a correct explanation for statement–I.

(2) Statement–I is true, statement–II is true; statement–II is not a correct explanation for statement–I.

(3) Statement–I is true, statement–II is false.

(4) Statement–I is false, statement–II is true.

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	4	3	4	4	1	3	2	1	2	1	3	1	2	1
Question	16	17	18	19	20	21	22	23							
Answer	2	2	3	4	2	4	1	3							

Important Notes